The Smithsonian Institution

A Revelation

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WASHINGTON, D.C.

1926

I

A UNIQUE LEGACY TO A NATION

JAMES SMITHSON was an Englishman and an aristocrat. He was also a scientist of note and he must have been a prophet. Though he knew little of democratic young America, had never visited the country, and lived in a day when Englishmen prophesied the collapse of its Government, nevertheless, in 1826, he left his fortune of \$550,000 *in trust* to the United States "to found an establishment for the increase and diffusion of knowledge among men." Of such faith and to so heavy a responsibility was born the Smithsonian Institution.

The Government as Trustee

The Institution is generally but erroneously supposed to be a Government bureau. Not only was it privately founded and privately endowed; it is privately directed and privately financed as well. A Board of Regents composed of the Chief Justice, the Vice-President, three Senators, three Representatives, and six private citizens, exercises oversight. Administration is in the hands of a permanent secretary, who is always a scientist, acting with the Executive Commit-

tee of the Board. The Government is merely the guardian.

Private Maintenance of Public Services

The Institution is privately financed. Organized in 1846, it operated for 12 years—till 1858—before it was charged with the expenditure of an appropriation by Congress, and for 24 years—till 1870—before the Government began to assist in any adequate way to support the great collections of the National Museum created by the Smithsonian. Later Congress recognized that nine other outgrowths of Smithsonian researches had become public necessities, and appropriated for their support also from time to time, but never has it made any grants for the Smithsonian itself. The Smithsonian finances its pioneering work in science from its private income.

One American's Endorsement

Thus the private nature of its purse gives the Smithsonian freedom of action and divorces it from political influence; Government guardianship gives it security and stability. Time has tested this freedom and this security. They have had such signal recognition as that given by Charles Lang Freer in placing his rare collections of Oriental and American art in the keeping of the Smithsonian, building a gallery to house them, and bequeathing a substantial fortune to upbuild the Oriental collections and to diffuse knowledge of Asiatic art.

II

EIGHTY YEARS: WHAT THEY HAVE MEANT TO THE NATION

THE SMITHSONIAN INSTITUTION has had eighty years in which to "increase and diffuse knowledge among men." The extent of its success can be read in the record of its completed achievements and of its continuous services. The majority of these come under the three headings of research, coöperation with governments, institutions, and individuals and publication and spread of knowledge.

Forerunner of the Weather Bureau

The Smithsonian has held the promotion of research in new fields to be a primary task. As a result of certain of its researches the Institution has initiated no fewer than ten of the Government's scientific bureaus. When meteorology was in its infancy, the Institution, under the guidance of its first Secretary, Joseph Henry, organized volunteer weather observers throughout the country, supplied them where necessary with instruments, and conscripted the telegraph to collect data

from them daily. The significance of this work met with immediate recognition, and the Government at length took it over and developed the United States Weather Bureau.

The United States Fish Commission, now under the Department of Commerce, sprang from the pioneering activities in the study of food fishes and river and ocean faunas of the second Secretary of the Smithsonian, Spencer F. Baird.

Science Aids in Opening a Continent

When military expeditions and railroad surveys began opening up the West, the Smithsonian organized the scientific staffs of these enterprises into geologists, botanists, zoölogists and ethnologists. Thus it was the Smithsonian primarily that made this continent's resources available to science and to scientific development and preserved records of their primitive state for posterity. One feature of this Smithsonian-initiated service graduated into a Government bureau as the United States Geological Survey, others, into the United States National Museum and the Bureau of American Ethnology.

The National Museum stands as the most tangible achievement of the Smithsonian Institution. It began with a small collection of miscellaneous curiosities. It now has over 10,000,000 specimens covering almost the entire field of human interests. It preserves the foundation of much of the world's knowledge, especially in the natural sciences and in the history of the

United States. It helps to enlighten 1,000,000 visitors a year. It stimulates research and the discovery of new knowledge.

The end of the last century saw many of the larger native American wild animals hunted to the point of extinction. To assist in preserving them the Smithsonian Institution organized what later became the National Zoölogical Park, which serves as an educational factor in displaying wild animals from all parts of the world in a living state.

Dr. S. P. Langley, the third Secretary, created the Astrophysical Observatory, and Smithsonian scientists still direct it. The Observatory stands now as the pre-eminent authority on the sun and its influence on life. One feature of its investigations gives promise of effectively improving weather forecasting.

Uniting Peoples and Governments

If knowledge has advanced on seven league boots in the last 75 years it is largely due to the universal interchange of new discoveries and ideas. To that interchange the Smithsonian has made the significant contribution of the International Exchange Service. The Smithsonian evolved this service to insure the widest possible distribution of its own publications. It soon became the channel for the distribution of American scientific writings abroad and foreign scientific writings in America. Governments at length recognized this idea as so sound that they adopted it and enlisted the organization as a medium of exchange for

their official publications. The Smithsonian still administers this Government bureau. In 1924 it sent and received a total of 460,658 packages of scientific and governmental literature. The shipments abroad went to 80 distributing agencies in 54 different countries, including Tasmania and Iceland, Liberia and Latvia. In addition in that year it served as the receiving agency for the restocking of libraries destroyed in the Tokyo earthquake.

In a further attempt to make knowledge available to all workers in science, the Smithsonian undertook the United States Regional Bureau of the International Catalogue of Scientific Literature.

The Fine Arts

The nine services mentioned above are wholly or partly concerned with scientific subjects. It is significant of the Smithsonian's broad interpretation of the spirit of its founder that the Institution also was given charge of the administration of the National Gallery of Art, in order that the fine arts might have their proper place in the Institution's plan for the increase and diffusion of knowledge.

Fruitful Researches—Aviation

Of the ten bureaus it has created the seven last mentioned are still administered by the Smithsonian for the Government. But these ten bureaus represent only a small portion of all the researches the Smithsonian has initiated. It was the third Secretary of the Smith-

sonian, Langley, who rescued aviation from ridicule by his profound study of the principles of aerodynamics and who, in 1896, built the first flying machines to make long flights under their own power.

With the Smithsonian's assistance Michelson made his determination of the standard meter in wave lengths, the basic measurement of the whole system of wave lengths—radio, X-ray, spectroscopic rays, and others. Likewise, Morley settled once for all the relative atomic weights of oxygen and hydrogen as basic for the atomic weight of all chemical elements.

Ultra-violet Rays

Ultra-violet rays are now used to cure rickets. Their importance and usefulness is only suggested by the discovery that they insure life on earth because they manufacture the layer of ozone in the upper air which prevents the earth's heat from escaping into outer space. It was the Smithsonian which subsidized Schumann—a German living in Hamburg—in the classic experiments by which these rays were brought into the service of medicine and science.

The researches mentioned so far are of the past. What of the present? The millions lost in fruitless exploration for minerals and oils are beyond calculation. The Smithsonian is promoting researches on fossil invertebrates which serve as a guide to the presence of minerals and oils.

It is promoting a survey of the crustaceans, including the lobster, the crab and the shrimp, which will

lead to an increase in food resources and more efficient exploitation.

Where Botanists Serve Industry

Important American industries depend upon the trees and shrubs of Mexico and Central America for their raw material. One industry imports raw gum 30 per cent. of which is waste, because it does not know from which particular gum tree the commercial product comes. Now, Smithsonian botanists are making the first thorough study of the trees and shrubs of Mexico and Central America. This is not only achieving the elimination of the waste mentioned, but it is making possible the commercial development of the hardwoods, the fruits, the food, drug, oil and cordage plants of the countries to the south of us.

Under Smithsonian direction, anthropologists are discovering new facts concerning the origin and antiquity of man in Java and South Africa; ethnologists are preserving the records of early Indian life on this continent and turning buried cities into national parks for the instruction and recreation of the nation. The Smithsonian's record, past and present, shows hundreds of such researches promoted.

Widespread Coöperation

An enumeration of all the types of coöperation in which the Smithsonian engages could only be made at the expense of brevity. The departments of the Government benefit by that coöperation. The fundamen-

tal research work of the Smithsonian in botany, for instance, has been basic in the Department of Agriculture's efforts to improve and protect farming. It was the work of a Smithsonian scientist during the war which made available to the Navy the quartz essential to the instruments used in the detection of the submarine.

The foreign governments of China and Japan, of Central and South America, have benefited through the work of Smithsonian scientists in investigating their natural resources.

Every recognized university, museum and scientific institution in this country and many abroad have also benefited. To them the Smithsonian has given over a million specimens, it has supplied them with publications, even with instruments, and has lent them experts from its staff for expeditions. The Institution has promoted many expeditions in its own name, for instance, the Roosevelt Expedition to British East Africa.

The Diffusion of Knowledge

It is probable that the Smithsonian's service in the diffusion of knowledge has even surpassed its service in the increase thereof. The Institution diffuses knowledge by lectures, by exhibiting and lending its collections, by granting facilities to students, by a dozen lesser means, but principally by its publications and replies to questions. The publications include three different series—the classic "Contributions to Knowledge," the "Miscellaneous Collections," and the "Special Publi-

cations." In addition the administrative bureaus, under the Smithsonian, publish seven other series. All these are recognized as authorities on the varied subjects with which they deal. The Smithsonian Annual Reports present to the non-technical reader in a single volume the outstanding scientific progress of each year. The edition of 10,000 is soon exhausted; 6,400 copies are distributed free to libraries in 102 countries or dependencies besides the United States and its territories.

The meaning of this is that the Smithsonian publications have the widest circulation, among scientists, of any scientific papers in the world. In whatever corner of the earth—in Borneo, in Siam—groups of thinkers are organized, one finds the green covers and golden torch of the various Smithsonian series holding the place of honor on their library shelves.

Where All May Inquire

Because of its careful replies to inquiries on technical matters, the Smithsonian Institution has come to be known throughout the world as a source of authentic information for the identification of plants and animals, for the determination of minerals, and for the solution of a thousand other scientific problems. In 1924, it answered 8,000 questions. A single answer sometimes requires the time of a scientist for several days.

III

CARRYING THE CREATIVE TRADITION INTO THE FUTURE

EIGHTY years ago the Smithsonian Institution initiated investigations which resulted in the creation of the United States Weather Bureau; thirty years ago, investigations which gave great impulse to aviation. Today, the Institution plans researches of no less importance and promise. In obedience to those principles of operation laid down by the first Secretary, Joseph Henry, in 1847, the Institution in the course of recent years has been outlining a broad program for the future.

Three Principles

James Smithson gave his fortune "to increase knowledge." Henry's first principle, therefore, directs the Smithsonian to investigation of problems of scientific promise irrespective of apparent economic value. It seeks facts. The fruitfulness of knowledge can always be guaranteed. The application of a fact is a single achievement. The discovery of a fact opens the door to unlimited achievement. There are now, roughly, 30,000 workers in applied science as against 3,000 in

pure research. And yet the economic scientist is helpless without the research worker in pure science.

Henry's second principle permits the Smithsonian to give attention to many branches of knowledge. That is why its record includes accomplishments in varied fields. The program it now proposes is the result of a survey of the entire scientific front in an endeavor to ascertain where best it may aid in filling gaps in knowledge.

To avoid duplication of effort and to insure the greatest advance in knowledge, a third principle forbids the Smithsonian to undertake or carry on work with which any other agency is definitely and efficiently occupied. Its proposed program will avoid competition; it will be conducted on a basis of coöperation.

The following paragraphs outline briefly the broad scope of the program in pure research now proposed by the Smithsonian. The specific projects mentioned are merely illustrations of the work planned in each field, which will be developed as funds become available.

Studies of the Sun

The studies of Smithsonian astrophysicists on the quality and intensity of the light and heat given off by the sun and stars stand alone. Scientists of the Institution discovered the fact of solar variation and the correlation thereof with the weather. They have brought their investigations to a point where the Argentine Government bases weather forecasts upon their daily

values of the solar constant. To perfect measurements of the solar constant, the Institution needs a fourth observing station in addition to those in Chile and California, and that in the Eastern Hemisphere, for which the National Geographic Society has just provided funds. To determine definitely the relationships between solar variations and weather, in the hope that long-range forecasting may become a fact, intensive studies are needed. To investigate the quantity and quality of the vital ultra-violet rays emitted by the sun; the intensity of sky radiation as well as of sun radiation; the effect of the earth's atmosphere on the quantity and quality of the ultra-violet rays; the effect of the sun's rays on food plants—for these and similar studies plans are ready.

The Oceans—a Fertile Field

The oceans help to distribute the heat of the sun; circulation of the super-heated waters of the tropics alone makes regions like Norway habitable to civilized man. The oceans, further, enable plants to live upon the earth for they are the source of most of the earth's rainfall. They furnish nearly three billion pounds of fish a year to the United States and Alaska alone. Yet, in spite of their importance, no comprehensive, co-ordinated study of them has been completed. The Smithsonian has already made notable contributions in marine biology, as in Secretary Baird's work in the early days of the Bureau of Fisheries. With the co-operation of existing agencies the Smithsonian now

proposes a comprehensive research program. To perfect methods the work will begin in a limited area, where oceanographic investigations are readily made and will extend to wider fields. It is proposed to determine first the basic plant foods of the sea on which all sea life depends, and to determine the food value to sea creatures of the bottom muds. From these biological beginnings the work will expand to a survey of physical and chemical conditions, and of the interrelation of the various forms to one another and to the sea environment.

The Significance of Fossils

What are the steps in life's progress from the age of trilobites to that of man? Do new forms of life appear suddenly, and if so, what may we fear or expect of the future? The answers to these questions lie imprisoned in the rocks—the fossils of animals that have lived in the past. But these extinct forms of life are more than historians. They are the key to the location in the earth of mineral and oil deposits, and their study will lead, therefore, to important economic developments. For 30 years unequalled collections of fossil faunas have been accumulating under the direction of the Smithsonian Institution. They include many forms new to science. The Smithsonian desires to meet the obligation which rests upon it to investigate these as well as to pursue investigations in the allied fields of geology.

The Story of the Indians

For the study of aboriginal man and the beginnings of culture, the Americas with their numerous Indian tribes provide an ideal field. But the fate of the Indian in North America is sealed. Many tribes have disappeared; others are constantly being drawn into the tide of higher civilization and their story and identity lost forever. The plough is burying traces of their past. Before it is too late the Smithsonian proposes to continue its studies of the remains left by such peoples as the Basketmakers, the Pueblo Indians and Cliff Dwellers, the Mississippi Mound Builders, the Choctaw and Natchez, to discover who constructed the shellheaps which line our coasts and rivers, and to survey the supposed routes through Alaska by which the first human immigrants came to America.

Smithsonian anthropologists propose further to expand the work of 30 years past on the rise of man by investigation of sites in Africa and Java where important discoveries of primitive man have come to light.

Man's Chief Enemy

Man fights for his sustenance and health against many living enemies. Chief of these are the insects. There are now known 650,000 kinds of them. There remain perhaps 3,000,000 more unknown to man. The mere naming of them, which is the important preliminary to dealing with them, at the present rate of about 6,000 a year, will require 500 years. In order that he may combat injurious species, man needs to know their

physiology and structure. On a knowledge of their respiration, for instance, may depend the choice of chemical sprays used to kill them. The Smithsonian program includes a plan for such basic studies.

Groundwork in Zoölogy

New knowledge is reached from the stepladder of the already known. The consolidation of existing facts is as needful a task as the discovery of new ones, and must precede such discovery. In the major groups of animals from mammals to worms, existing information must be gathered from many lands and many languages, checked with type collections of creatures, and issued as basic monographs. Only so can wasteful duplication of effort be avoided. Only so can the basic relation of one species to another and its position and function in the world of other creatures be comprehended. The material under the direction of the Smithsonian Institution constitutes the largest and best balanced representation of the animal kingdom of any institution in this country. The preparation of monographs dealing with its zoölogical collections is therefore a duty.

To increase our knowledge of the animal kingdom before man's encroachments wipe out many existing groups, the Institution purposes to transform its past sporadic explorations into intensive expeditions covering systematically those parts of the world where knowledge of the fauna is incomplete.

Other projects contemplated in this field include

studies in anatomy, in the diseases of wild mammals and birds, and similar topics.

South American Plants

Less is known of the plant life of northern South America than of almost any other section of the Western Hemisphere. Before plants yielding drugs, gums, fruits, fibres, dyes and oils can be efficiently made available to the world, they must be discovered, named and described. In an expansion of work already begun, the Smithsonian, in coöperation with four other institutions, plans as part of its botanical program to study the plants of Colombia, Ecuador and Venezuela.

Aids to the Engineer

Typical of projects in other fields, there are the mathematical and physical tables, which would collect in a form convenient for engineer and scientist mathematical formulæ and methods. The Smithsonian Physical Tables, which have gone through seven editions since 1910, represent profitable work in this field already begun.

So much for illustrations of some of the specific projects in fundamental research proposed by the Smithsonian. They are broad in scope. Their possibilities are unlimited. For their successful promotion, the Institution needs funds.

IV

TWENTIETH CENTURY WORK ON A
NINETEENTH CENTURY
ENDOWMENT

THE SMITHSONIAN's activities have increased a hundred fold in eighty years; its endowment has doubled. The endowment at present is \$1,200,000, from which the annual income approximates \$65,000. From that sum, in 1924, the total available for research was \$10,000, and for publications, \$5,000. Compare these figures with the \$27,000,000 endowment of the Carnegie Institution from which it derived in the year 1924 an income of \$1,400,000, permitting it to spend for research over \$1,000,000 and for publications, \$100,000.

Major Activities Grippled

The Smithsonian's \$65,000 a year is so inadequate that since the War it has had to curtail its major services of research and publication. It has had on hand for several years many of the projects outlined above, with no funds to undertake them.

It has been forced to suspend the "Contributions to Knowledge" series, to reduce the "Miscellaneous Col-

lections" series to a third of the former size, to delay printing such manuscripts as Dr. Joseph A. Cushman's monograph on the Foraminifera, which has, since its appearance, enabled the oil companies of the country to save large sums, and to reject others equally important, resulting in a handicap to science and industry.

The loss here lies not only in the fact that certain scientific papers miss publication. It means also that scientific groups throughout the world fail to be informed of developments on which to base further advances in knowledge. For, equal in importance to the fact of publication is the Smithsonian's principle of free distribution to scientific organizations in every land. Research without publication is largely futile, both from the scientific and from the public point of view.

In addition, lack of funds has curtailed to students the usefulness of such essential parts of the Smithsonian's research plant as its library. No subject catalogue exists; 8,000 volumes in current use need binding; 30,000 lie uncatalogued and therefore inaccessible.

The Solution

The Smithsonian has actively striven to balance the deficit in its income, principally by securing private gifts for the conduct of certain work. But since the War these gifts have proved inadequate to carry on even the most important of the Institution's activities. It now seems wise to turn to the country for support. The

Smithsonian has never made such a request before. It does so now in the conviction that Americans, recognizing the Institution as a national possession and a national responsibility as well as a national servant, will see here, not an appeal, but an opportunity to share in an investment the returns from which, spiritual and material, have already been beyond estimate. Who will dare measure the value, for instance, of the weather reports, which form an integral part of every newspaper? The work of the Smithsonian in the past was primarily responsible for the existence of these reports. Furthermore, the Institution is an investment of rare stability. Gifts made to it gain the Government as trustee. So long as the United States Government endures, the Smithsonian will endure. So long will gifts and bequests made to it perpetuate the name of a patron, in the largest sense, of mankind.

To carry out projects already entered upon, to undertake the broad program proposed, to restore the efficiency of its distribution of knowledge by the resumption of publication on the pre-war scale, and to utilize its unparalleled resources in collections and equipment in stimulating and aiding the exceptional mind in research, the Smithsonian Institution needs a minimum addition of \$10,000,000 to its endowment.